



# Naval Research Laboratory

## VXS-1

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# Navy's Airborne Laboratories



## 2 Research Configured NP-3D

(Combat Theater Capable)

1 AEW NP-3D

2 RC-12

4 Scan Eagle UAS

1 MZ-3A Airship





# Research Configured NP-3D



- Combat Theater capable
- Configurable Interiors
- Project/Research Electrical Load Centers
- 50 – 100 AMPs available
- Modified Bomb Bay equipment pallets
- 20" floor rails to accommodate up to 10 equipment/operator consoles
- 10,000 lb equipment payload
- Support up to 11 project specialist on flights up to 12 hours in duration
- Aircraft Navigational data access
- Wing wiring to support up to 10 external pod's
- Research configured nose/tail
- Project dedicated static pressure port
- Project Communication

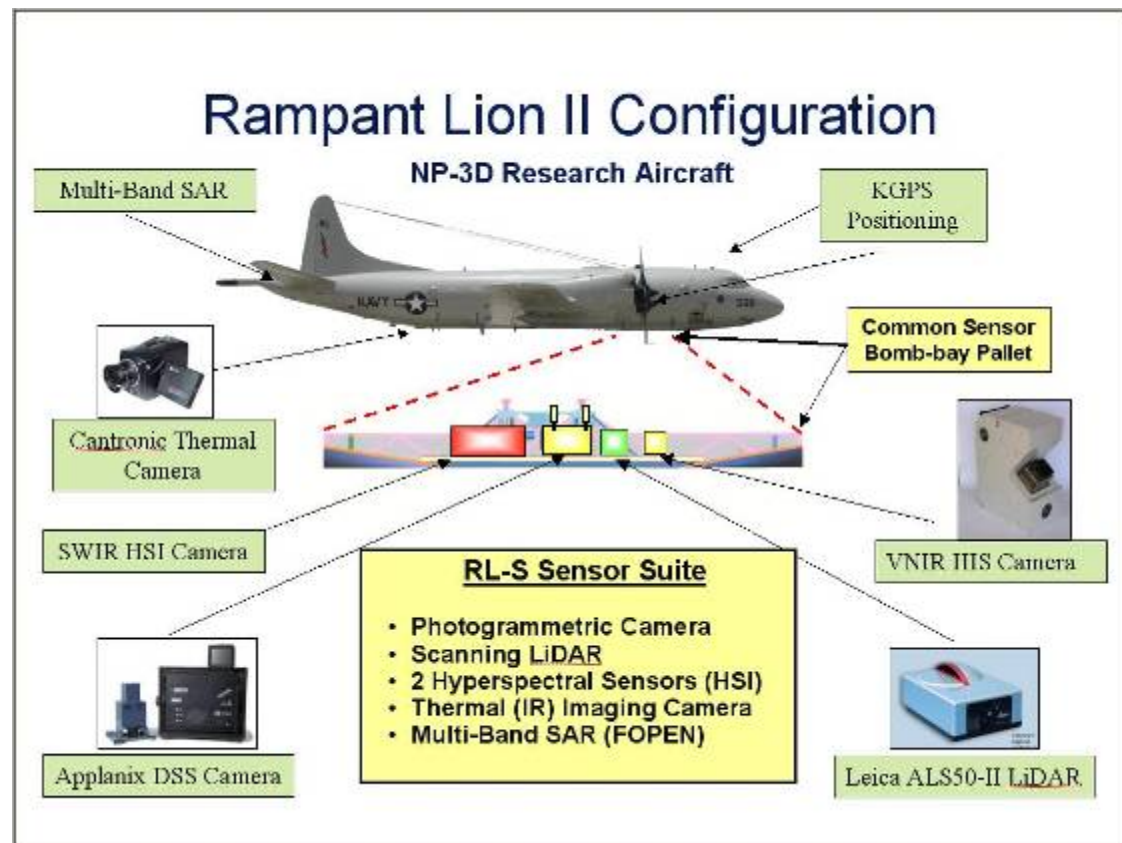




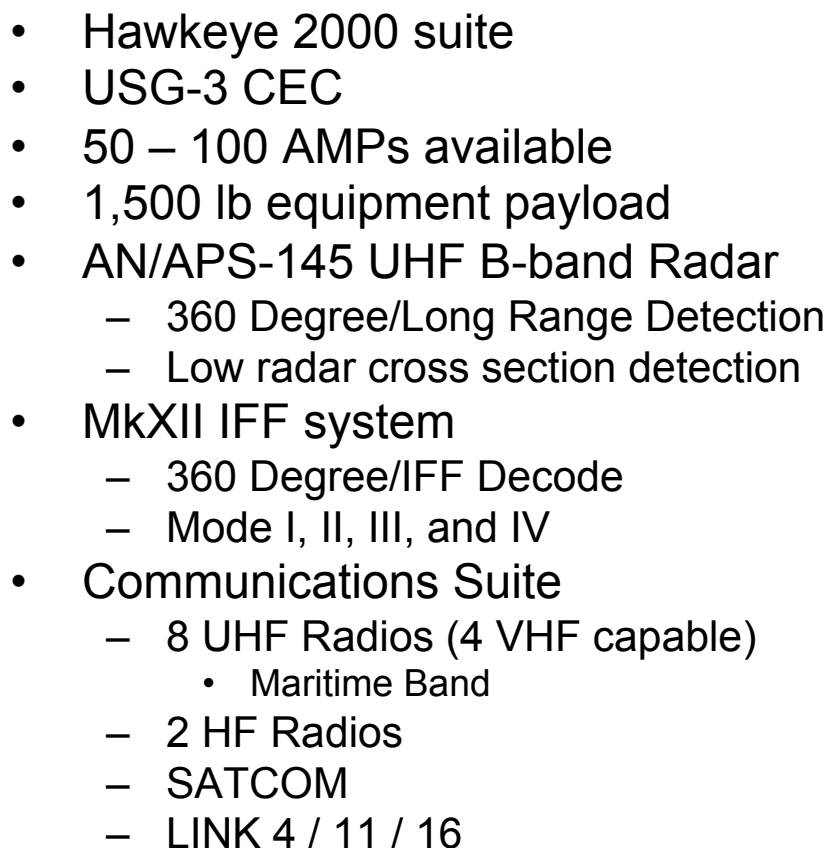
# Rampant Lion Capabilities



- Hyperspectral, IR & Photogrammetric Optics, Multi-band SAR, LiDAR terrain mapping
- Sensor Suite data is *co-registered* by K-GPS, and recorded on RAID storage
- Photogrammetric data gathered can be rapidly distributed to end user
- Hyperspectral and LiDAR require extensive post-processing
- Anticipate a near real time processing capability for MB-SAR





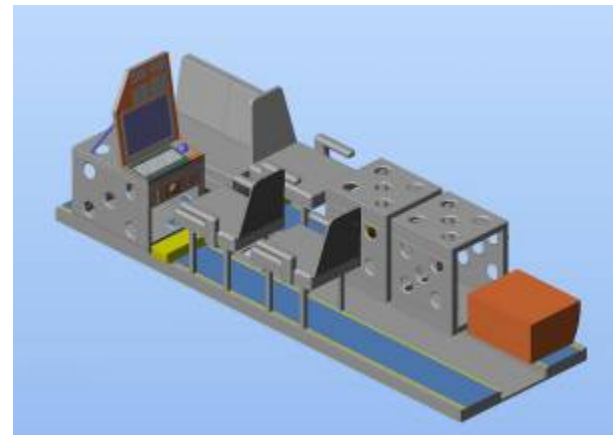




# RC-12 Capabilities



- Lower Belly Radome to accommodate radar/electro optic projects
- Engines wired to support project specific generator
- 25 or 60 AMPs available
- Research Load center
  - Provide Ckt breakered 115Vac for projects
  - Isolate projects from basic A/C systems
- Floor rails to support up to three operator/equipment stations
- 1,200 lb equipment payload
- Removable seats, (can be utilized for transporting personnel/parts in support of projects)





# Scan Eagle Parameters



## PERFORMANCE

- Max Horizontal Speed 75 knots
- Cruise Speed 48 knots
- Ceiling 19,500 ft
- Endurance 12+ hours

## DIMENSIONS

- Wing Span 10.2 ft
- Fuselage Diameter 7 in
- Length 5 ft

## WEIGHTS

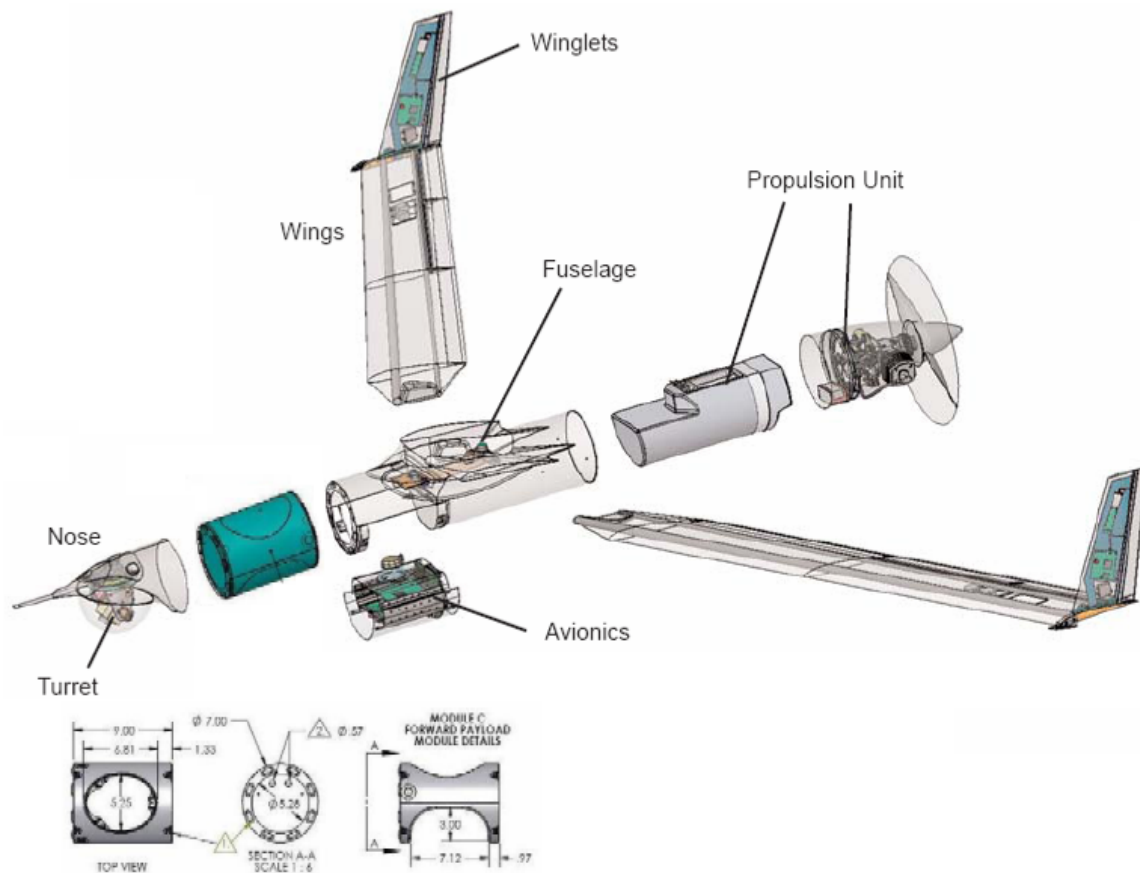
- Empty Weight 28 lb
- Fuel and Payload 15 lb
- Max Fuel 12.1 lb
- Max Takeoff Weight 44 lb

## FREQUENCIES (MHz)

- C2/Telemetry: 1350-1390
- Video Downlink: 2300-2500

## PAYLOADS

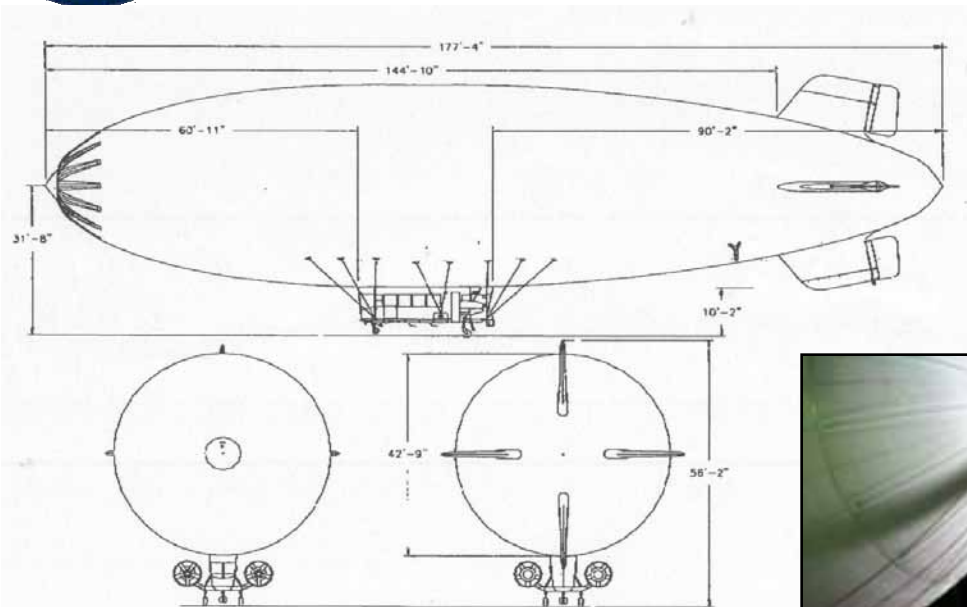
- Sony FCB-EX780 EO Camera
- DRS Tech. E3500 IR Camera



**SE UAS has over 100,000 hours of flight time in theater  
with clearance to operate at multiple locations**



# MZ-3A Airship



## DIMENSIONS

Length 178ft

Height 55ft

Width 46ft

## ENVELOPE

Volume 170,000 cu ft

Length 175.5 ft

Diameter 43 ft

## PERFORMANCE

Max Speed 45 KIAS

Max Altitude 9500 ft

Fuel Burn @ 30 KIAS = 11 gal/hr

Max ROC / D ~1400fpm/2700fpm

500-2500lb useable load

12 hours max endurance

## MAIN PROPULSION

2 x 180HP Lycoming IO-360

Prop 65" diameter, 5-blade

## CONTROL CAR/GONDOLA

Overall Length 25.5 ft

Overall Width 6 ft

Interior Length 11.4 ft

Interior Height 6.3 ft

Seating: Pilot + 9 passengers

## ELECTRICAL POWER

1x 28 volt DC 90 amp Utility Bus

2.2 kw aux power unit

Provides 2x10 amp 115/60

## MOORING RADIUS

Fixed Mast 300 feet

Mobile Mast 200 feet







# Recent Accomplishments

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- Iraq deployment in November 2008
- Coast Guard MIA flight completed over Greenland
- SOUTHCOM multi-sensor deployment completed in January of 2009
- Magnetic survey completed in June 2009
- NOAA NGS deployment to Alaska completed in July 2009
- TEW – Electronic Surveillance Assessment in October 2009
- Cable HNR in October 2009
- MDA – JFTM3 in November 2009
- PASS / OADT (ONR) ongoing since December 2009 to present



# Future Missions



- Cable HNR – 150 hrs planned in spring and summer 2010
  - C-12 mission involving Harris HNR communications package
  - Cherry Point and Fort Dix testing areas
  - Deep Lightning Bolt initiative
- TEW – Electronic Surveillance Assessment in November 2010
  - Follow on to efforts started in fall 2009
  - Transition to C-12
- MDA – 150 hours planned for missions scheduled for fall and winter 2010
- PASS / OADT (ONR) – 250 hours planned for summer and fall 2010
  - Hawaii tests planned in addition to numerous local area flight testing
  - OA-DT3 planned for fall 2010 in Camp Lejeune area
- Blue Devil Spiral 2 – Counter IED effort planned for summer and fall on MZ-3A



# Summary



## FLEXIBLE

- Swift install & flight clearance IAW NAVAIR
- Modified for power & payload
- Simultaneous project integration

## CAPABLE

- World-wide deployable
- ONR/NRL oversight, able to accept funding quickly and from multiple sources

<u>RATES</u>	<u>FY10</u>	<u>FY11</u>
• NP-3D /flthr	\$13K	\$15K
• AEW NP-3D /flthr	\$20K	\$20K
• RC-12 /flthr	\$2K	\$2.8K
• Scan Eagle /fltday	\$25K	\$25K
• MZ-3A /flt day	\$12K	\$12K

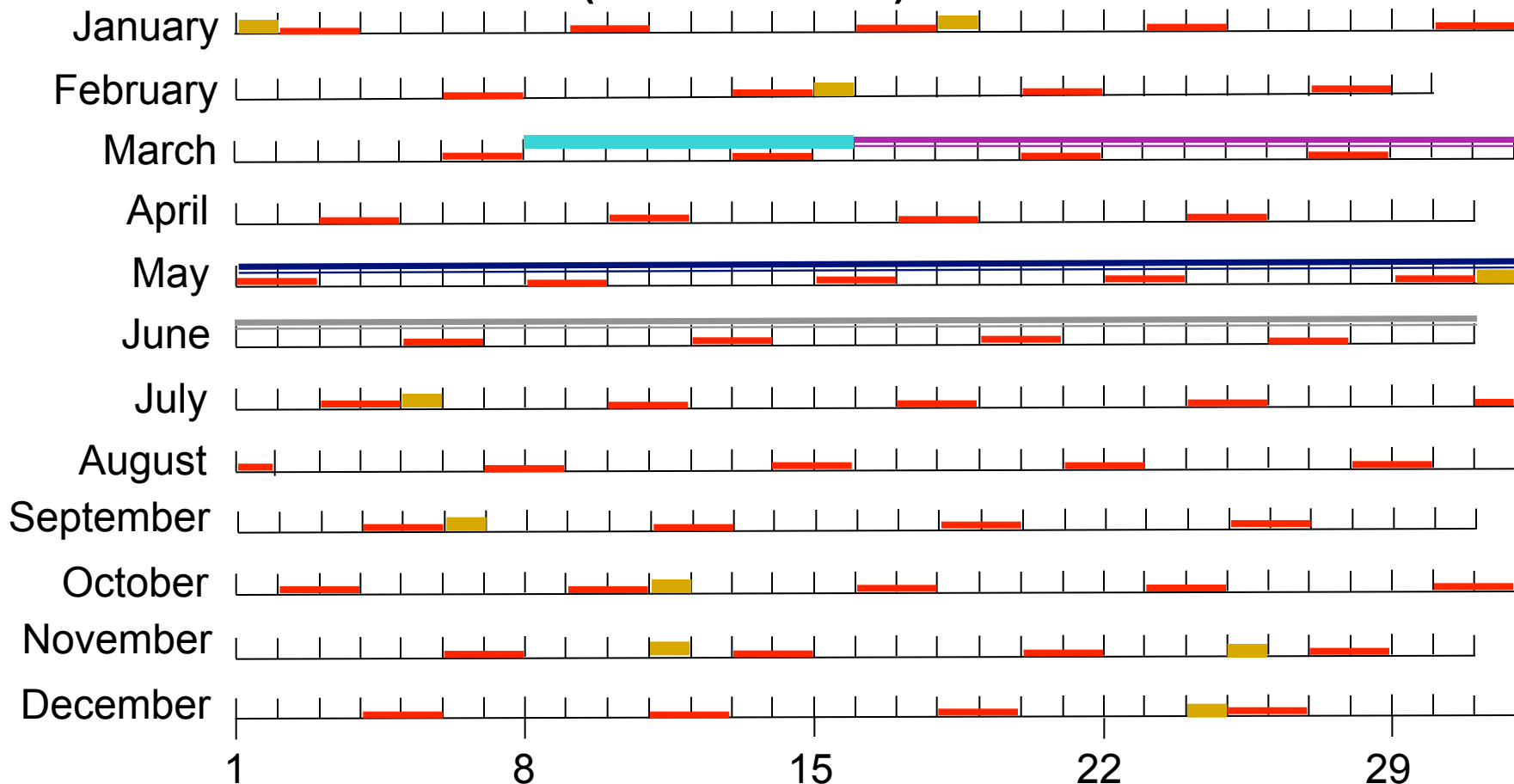








# NPS/CIRPAS

## Twin Otter Schedule 2010

(as of 10/21/09)



Federal holiday:   
Weekend:   
Integration:   
Ferry flight: 

**Projects:** Albrecht – BACEX (confirmed)   
Seinfeld – CalNex (confirmed)   
Melville – HiRes (confirmed) 





# Points of Contact

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# Navy Airship Information Brief

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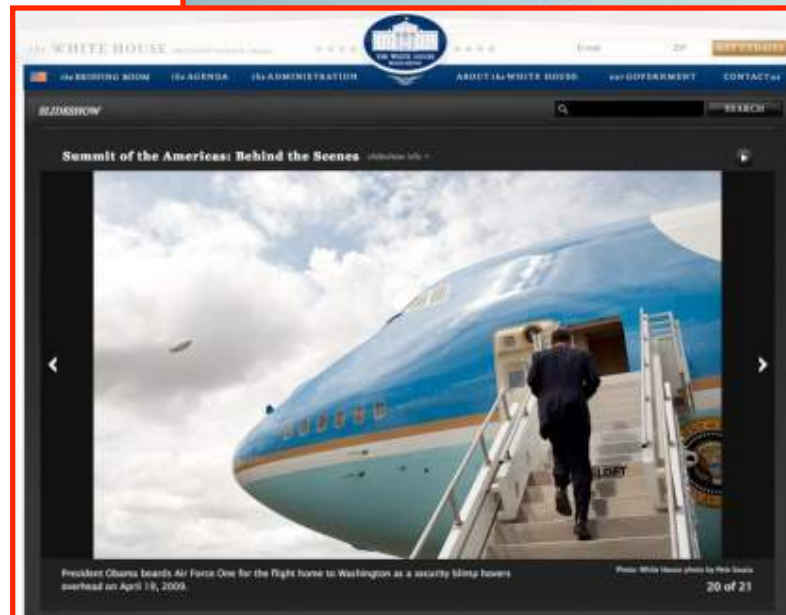
## *Airship Capabilities Past, Present, Future*

**April 2010**



# Agenda

- Mission Categories
- Historical Capabilities
- Current/Near-Term Capabilities
- Future Potential
- MZ-3A Status
- Design Criteria
- Funding
- Take Aways





# Mission Categories

Risk



- **Category 1: Near Shore/Port/Urban Areas/Facilities Surveillance**
  - General Purpose Surveillance
  - Payload 1-4 thousand lbs, Mission Period: 8-12 hrs
  - **Affordable** Presence, Low Risk, **Available NOW**
- **Category 2: Off Shore Patrol: Affordable Airborne Presence**
  - Large classic airship capable of carrying 3-20 tons
  - Mission periods: weeks vice hours with crew and UAV's aboard
  - Mission radius ~ 500 miles; UAV's could extend surveillance range
- **Category 3: Trans-oceanic Heavy Lift:**
  - Hybrid Aircraft: 500 ton payload "From Fort to the Fight"
  - Insert "ready-to-fight" forces into austere AOR (no forward support)
  - Not susceptible to torpedoes/mines; high cargo survivability
  - Faster than surface ship (70-100 kts) ;  $\frac{1}{4}$  fuel of conventional A/C
  - 30T variant: CISR/TACAMO/SOF Insertion/Sea Base Connector
- **Category 4: Strat-Sat: (HAA Airships and Balloons)**
  - Unmanned, 70,000 ft altitude, fill Near Space Gap by 2015
  - Relatively cheap alternative to satellites
  - 325 NM LOS, 332,000 sq-NM Collection Footprint
  - Increase DoD Com Network Resilience





# Historical Capabilities

## US Navy Operations 1915 - 1962

### Early Warning

#### Convoy escort



#### SAR



#### Patrol (ISR)



#### ASW



**Navy needed persistent , reliable platforms to counter the German ASW threat.**

**WWII success inspired large airships for Early Warning through 1962.**



# Historical Capabilities

Performance Comparison

Type	K-Ship (1940) (mission specific design)	ZPG-2W (1955) (mission specific design)	ZPG-3W (1958) (mission specific design)	MZ-3A (2008) (COTS airship)
Volume cu/ft	456,000	975,000	1,465,000	170,000
Length	253 feet	343 feet	403 feet	178 feet
Payload	4,100 lbs.	11,200 lbs.	32,366 lbs.	2,500 lbs.
cruise / max speed (kt)	50 / 67.5	40 / 68.5	39 / 82	35 / 45
Endurance at cruise / range	59.0 hours 2,950 nm	52.5 hours 2,100 nm (264 hrs/9,448 miles)	69 hours 2,415 nm	15 hours 494 miles
Flight Crew	8	14	25	1 pilot (9 pax)



# 1980's Development



Skyship 600



Skyship 1000 (Above) & YEZ-2A (Below)





# Current Capabilities

Performance Comparison

Type	A-170	Skyship 600	Skyship 1200	Polar 400 (Experimental)
Volume cu/ft	170,00	235,000	448,000	141,000
Length	178 feet	194 feet	232 feet	163 feet
Payload	2,500 lbs.	2,800 lbs.	6,400 lbs.	UNK
cruise / max speed (kt)	35 / 45	40 / 59	40 / 70	~30 / 58
Endurance at cruise	15.0 hours	24 hours	48 hours	60 hours
Flight/Ground Crew	1 / 12	2 / 15	2 / 15	1 / 4



# Historical Development Path

Volume  
m cu ft

Useful load  
Increment = 1 ton



Endurance  
@ 35kts  
Increment = 12 hours



Max altitude  
Increment = 5kft



Fully Designed  
Never Built



3.0 m

2.5 m

2.0 m

1.5 m

1.0 m

0.5 m

0.25 m

YEAR

1940

1950

1960

1970

1980

1990

2000

2009

Actual Path

Missed Tech  
Opportunities

1980's intent

Today

"K" Class

ZPG-3W

YEZ-2A

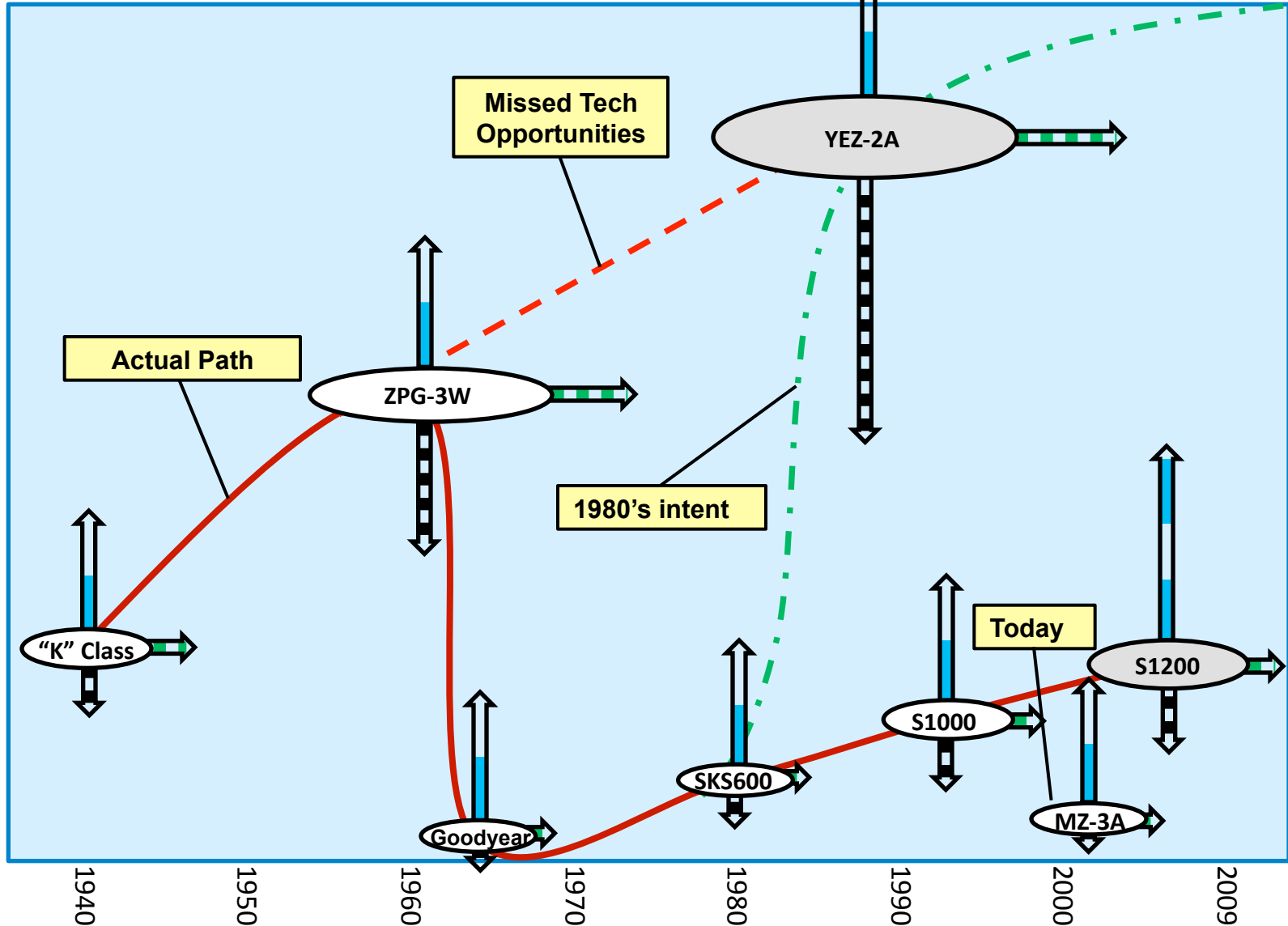
Goodyear

SKS600

S1000

S1200

MZ-3A





# Future Potential

## Long-Endurance Multi-Intelligence Vehicle (LEMV)

- Quick Reaction Capability
- Army led, Joint program
- Funded FY10-15 (OSD ISR task force)
- Provide affordable, persistent ISR platform for operational demonstration
- Operational 18 months from date of award contract
- Specifications:
  - Endurance = 3 weeks
  - Altitude = 20,000 ft
  - Payload = 2500 lbs
  - Power = 16 kw (to payload)
  - Unmanned
  - Multi-surface landing capability

3 weeks at 20kft while carrying a 2500 lb payload





# Future Potential (Near Term)

Affordable low risk near term solution

Radar platforms

internal

Stern thrusters

Yaw and pitch

Sentinel 1200

Yaw and pitch

Bow thruster

2 x 300 HP Diesel engines



EO/IR/Comms

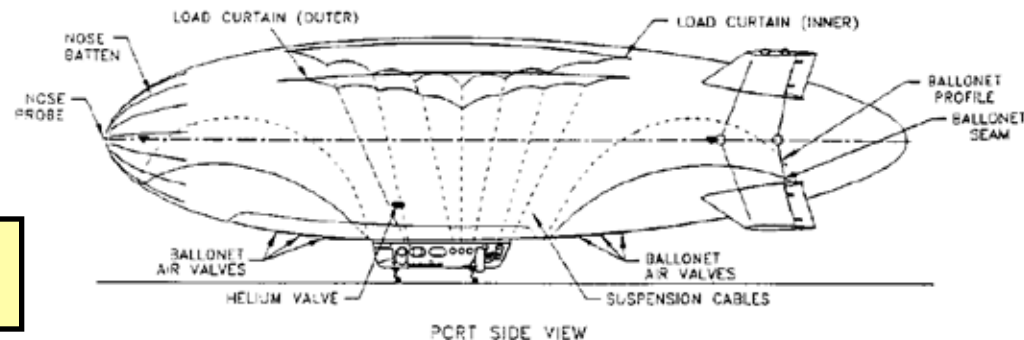
Payload 3 tons  
(5000 ft, 40 kts for 48 hours)



# Airship Design Criteria

For a purpose-built airship, the following criteria are critical design parameters for sizing and performance:

- Manned vs. optionally manned
  - flight controls and instrumentation
  - crew accommodations
- CONOPS
  - landing arrangements
  - thrust strategies
- Payload
  - installation accommodations
- Altitude
  - displacement/envelope size
  - ballonet ratio
- Endurance
  - fuel capacity
- Electric Power
  - generator capacity
- Speed
  - engine size
  - propellor



Airship technology is mature. Reasonably sized airships can be built at low risk.





# Funding and Affordability

- Remainder of FY08/09 Congressionals being placed on contract (\$2.4M)
- Anticipate \$5M FY10 Congressional
- Pursuing DoD funding for project support
- Program Element (PE) is available
  - 0603268N (Naval Airship)
  - President's Budget 2010 may utilize
- A purpose built airship with 3 ton capacity can be built within 8 months at low risk for ~\$10M.
- Capable of housing large aperture devices in low-vibration, electronics friendly environment.
- Extreme endurance and dwell capability
- Fuel expense ~70% less than fixed/rotary wing for comparable payloads.
- Cost per hour further reduced with multiple ship system.

## PE Description:

*Includes RDT&E funds for concept definition, design development, engineering development and flight testing of preproduction prototypes for a Naval Airship.*



# Take-Aways

- Although counterintuitive, airships are the most survivable air platform.
- Airships are persistent due to low fuel burn; endurance can be measured in days.
- Airships possess virtues of both ships and fixed/rotary-wing air vehicles; they offer airborne vantage with ship-like persistence.
- The greatest advances in Aerospace technology are applicable but have yet to be applied to the construction of a modern airship.
- Airships require some unique servicing and handling infrastructure to include mobile masts, mechanical ground handling systems, helium service carts, etc.
- Modern airships have minimal hangar requirements and are designed to remain exposed to the elements for the majority of their operational life.





*Questions and/  
or  
Comments*